10/552325

JC20 Rec'd PCT/PTO 07 OCT 2005

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BILATERAL DRIVE

Description

The invention relates to a bilateral drive for rotating a drive wheel connected to an adjusting device according to the preamble of patent claim 1.

From DE 198 55 285 A1 a bilateral manual drive is known for generating a rotational movement which starting from a zero point position of a drive lever which is able to swivel about a drive axis follows selectively in one or other rotational direction. During rotation of the drive lever from the neutral position contact bearing faces of circular section shaped coupling elements bear with force locking engagement against the opposing partially circular shaped faces of a cylindrical drive face of an output element and entrain the output element in the circumferential direction whilst during return of the drive lever into the neutral position the force locking engagement of the coupling elements against the cylindrical shaped drive face is lifted so that the output element is not entrained.

A bilateral adjusting device known from DE 199 07 483 C2 for generating a rotational movement has a housing in which are mounted a drive element, an output element

which can be angularly adjusted by actuating the drive element, and a loop spring with several windings which are supported on the inside wall of the housing and block any torque introduced from the output side whilst in the event of torque introduced on the drive side they trigger the transfer of torque from the drive element to the output element. The angled ends of the loop spring are connected to a transfer element mounted between the drive element and output element.

Through a dynamic reversal a bilateral drive can be produced from this torque lock wherein the output element is connected to a drive lever and the cylindrical housing is replaced by a cylindrical drive wheel so that during swivel movement of the drive lever the loop spring is expanded through the transfer element from the drive lever and transfers the swivel movement of the drive lever to the cylindrical inside face of the drive wheel.

With the known bilateral drives high flat surface pressures occur as a result of a linear bearing of the transfer elements which are designed as circular section shaped coupling elements against the drive face. The use of a loop spring requires several windings to provide sufficient force locking engagement of the loop spring against the cylindrical inside face of the output element. Nevertheless as a result of the forces which have to be applied when transferring torque there is the danger that in the event of overload the angled loop spring ends are bent round so that the bilateral drive becomes unable to function.

It is therefore the object of the present invention to provide a bilateral drive of the type mentioned at the beginning for turning a drive wheel connected to an adjusting device which enables torque transfer from the drive lever to the drive wheel with slight surface pressure of the force transfer elements, which has a very simple compact structure with a high service life and which is cost-effective to manufacture.

This is achieved according to the invention through the features of claim 1.

The solution according to the invention enables torque transfer from the drive lever to the drive wheel with slight surface pressure of the force transfer elements and has a simple space-saving construction with a high service life and is cost-effective to manufacture.

Through the expansion of the spring element over a wide contact surface area against the cylindrical drive face of the drive wheel as well as through the expansion cams of the coupling element which are able to tilt about an axis spaced from the drive axis a force-locking engagement is produced to transfer torque from the drive lever to the drive wheel over a wide contact surface area and therefore with low surface area pressure.

Since only some few component parts are required for the force transfer from the drive lever to the drive wheel the bilateral drive can be manufactured simply and cost-effectively.

The expansion cams are preferably arranged at different radial distances from the drive axis on the drive lever so that the expansion cams during swivel movement of the drive lever about the drive axis complete a tilting movement whereby the actuation levers which are connected to the spring element are expanded and the spring element is expanded to bear against the cylindrical drive face of the drive wheel.

For a play-free contact bearing of the expansion cams against the expansion faces of the actuation levers at least one expansion cam is designed pretensioned wedge-shaped and mounted radially displaceable between two contra-rotating wedge faces of the expansion faces of the actuation levers but is supported with self-locking action opposite the other expansion cam.

The other expansion cam is also preferably designed wedge-shaped with oppositely aligned wedge form and is clamped between counter wedge faces of the actuation levers.

In order to secure a slight readjustment of the expansion cams for play-free contact bearing against the expansion faces of the actuation levers on the one hand and to secure the self-locking action between the mutually radially tensioned expansion cams with a force-free contact of the wedge faces of the actuation levers against the contact faces of the wedged expansion cams on the other hand the contact faces and the wedge faces have a lower coefficient of friction than the opposite support of the wedge-shaped expansion cams.

In order to increase the self-locking action the opposite support of the wedge-shaped expansion cams can be formed wedge-shaped with a wedge angle which is less than the wedge angle included between the contact faces of the wedge shaped expansion cams and the wedge faces of the actuation levers, more especially half the size.

The solution according to the invention allows several different embodiments which serve the same principle. A first embodiment is characterised in that the spring element consists of a spring strip whose ends are angled parallel to each other and are inserted in sockets in the actuation levers.

The actuation levers can be disc-shaped and have a peripheral surface area which is adapted at least in part to the cylindrical inside wall of the drive wheel.

In an alternative embodiment the actuation levers can consist of a one-piece spring-elastic expansion lever which holds the expansion cams and drive axis and has on the side opposite the expansion cams in relation to the drive axis an elastic web which takes up the tension forces.

In a further alternative the expansion lever and a circumferential face adapted to the drive surface of the drive wheel can be combined into one moulded part which consists of a stamped steel part, a plastics part or a sintered part and is inserted without pretension into the inside face of the drive wheel.

Resetting springs can be mounted between the actuation levers or the expansion lever so that the actuation levers or the expansion lever move the expansion cams after swivel movement of the drive lever back into an initial position which corresponds to the neutral position of the drive lever.

To reset the drive lever after a swivel movement into the neutral position a lever resetting spring is mounted between the drive lever and a locally fixed stop on the housing of the bilateral drive.

With the embodiments mentioned above the drive lever has a link designed as an oblong hole on to the drive axis in order to ensure the required motion play during expansion of the actuation lever or cross stay.

In a further variation of the solution according to the invention which can be applied to both embodiments above the expansion cams are mounted in different radial distances from the drive axis on a reinforcement lever supported with swivel action on the drive lever so that the required motion play is set up by the reinforcement lever whilst the drive lever can be attached to the drive axis free of play and is consequently optimally centred.

The connection of the reinforcement lever to the drive lever can be arranged radially in alignment with the expansion cams and can be provided either on the same side in relation to the drive axis as the expansion cams or on the side of the reinforcement lever opposite the expansion cams in relation to the drive axis.

The invention will now be explained in further detail with reference to several embodiments and to the figures in the drawings. They show:

Figure 1 a sectional view of a bilateral drive with a spring strip and actuation discs;

Figure 2 a sectional view of a bilateral drive with a spring strip, actuation levers and wedge shaped expansion cams;

Figure 3 a sectional view of a bilateral drive with an elastic shaped part and a spring strip;

Figure 4 a sectional view of a bilateral drive with an elastic shaped part with resilient circumferential face; and

Figures 5/ 6 sectional views of a bilateral drive with a shaped part with resilient circumferential surface and a reinforcement lever.

The bilateral drive illustrated in Figure 1 has a drive lever 2 which is capable of swivelling about a drive axis 10 and which is attached through an oblong hole 20 to the

drive axis 10 free of play. A swivel movement of the drive lever 2 in the direction of the arrow S registered on the drive lever 2 or in a counter direction leads to a rotational movement of a drive wheel 1 which has a cylindrical drive face inside which is mounted a transfer device which transfers the torque generated through the swivel movement of the drive lever 2 to the drive wheel 1 and thereby entrains the drive wheel 1 in the swivel direction of the drive lever in the circumferential direction when the drive lever 2 is moved away from a neutral position whilst the drive wheel 1 is not entrained during return of the drive lever 2 back into the neutral position.

The sectional view of the bilateral drive according to Figure 1 only shows the elements of the bilateral drive which are of significance for the present invention. Where applicable further elements are provided such as distance sleeves or spacer discs, more particularly a brake housing (not shown in Figure 1) is provided in which a brake device is mounted which is connected to the drive wheel 1 so that torque transfer on the output side is blocked whilst the locking action is lifted in the event of torque transfer on the drive side. The brake device thus prevents displacement of the bilateral drive when external forces appear. In particular it ensures that in the event of crash forces occurring the drive wheel 1 is prevented from turning.

The transfer device contains a spring strip 6 as well as two actuation discs 51, 52 mounted on the drive axis 10 with spring strip sockets 511, 521 in which are inserted the spring ends 61, 62 of the spring strip 6 which are angled parallel to each other. Furthermore the transfer device contains a coupling element in the form of two expansion cams 31, 32 mounted with slight play between the actuation discs 51, 52 and connected to the drive lever 2, more particularly forming part of the drive lever 2, so that during swivel movement of the drive lever 2 they tilt about a virtual axis which is spaced from the drive axis 10. The expansion cams 31, 32 bear against the expansion faces 515, 525 of the actuation discs 51, 52 which they force apart during swivel movement of the drive lever 2 and as a result of the ensuing tilting movement about the virtual axis which lies outside of the drive axis 10 so that the spring strip 6 is expanded over the spring strip sockets 511, 521 and thus the swivel movement of the drive lever

2 is converted through entrainment of the drive wheel 1 into a rotation of the drive wheel 1 into the swivel direction of the drive lever 2.

If the friction between the spring strip 6 and drive wheel 1 is comparatively low then to generate sufficiently large tension forces the distance between the cams 31, 32 can be reduced. This gives rise to relatively large pressure forces of the cams 31, 32 on the expansion faces 515, 525 of the actuation discs 51, 52 which requires corresponding stable dimensions. The angular clearance on the drive lever 2 is also unfavourably affected if the distances between the cams 31, 32 are small. Therefore the largest possible distance between the cams 31, 32 is selected in dependence on the relevant friction conditions between the spring strip 6 and drive wheel 1 so that the outer cam 31 is mounted radially as far out as possible.

In order to reset the transfer device and thus the drive lever 2 into the neutral position two resetting springs 81, 82 are provided which are supported on bearings 512, 513 and 522, 523 of the actuation discs 51, 52 and on bearings fixed on the housing. The resetting force which is to be applied by the resetting springs 81, 82 can be kept small. With relative movement of the actuation discs 51, 52 caused through the expansion cams 31, 32 the resetting springs 81, 82 are tensioned to expand the spring strip 6 and are consequently relaxed during return of the drive lever 2 into the neutral position until the drive lever 2 has reached the neutral position.

An additional pretensioning of the spring strip 6 is not necessary in the arrangement illustrated in Figure 1 since the resetting springs 81, 82 produce the pretension required by the spring strip 6 when the drive lever 2 is actuated so that the spring torque produces the contact bearing moment of the cams 31, 32.

If the drive lever 2 is actuated in the direction of the arrow S then a torque is exerted on the expansion cams 31, 32 which forces the actuation discs 51, 52 and thus the spring strip 6 apart and entrains the drive wheel 1 through the friction. The oblong hole 20 in the drive lever 2 ensures free movement at this point.

Figure 2 shows in a sectional view of a bilateral drive a modified transfer device with a play-free connection of expansion cams 33, 34 with actuation levers 53, 54 for

expanding a spring strip 6 in the event of torque transfer from the drive lever 2 to the drive wheel 1.

The expansion cams 33, 34 are in this embodiment designed wedge-shaped and bear against the wedge faces 533, 543 and 534, 544 of the expansion faces of the actuation levers 53, 54 which are supported free of play by means of bores 630, 540 on the drive axis. The expansion cam 34 which is mounted at the lesser distance from the drive axis 10 has a web 35 which is inserted by its wedge-shaped end into a wedge-shaped recess 36 of the wedge-shaped expansion cam 33 which is disposed at the greater distance from the drive axis 10 and which (web 35) is supported by a spring 83 against the expansion cam 33. The expansion cam 34 closer to the drive axis 10 together with the web 35 are part of the drive lever 2 which is supported through an oblong hole 20 on the drive axis 10.

Through the friction conditions between the contact faces of the wedge-shaped expansion cams 33, 34 and the opposing wedge faces 533, 543 and 534, 544 of the expansion faces of the actuation levers 53, 54 on the one hand and the adjoining wedge faces of the recess 36 of the outer expansion cam 33 and web 35 and through the corresponding wedge angle it is ensured that the expansion cams 33, 34 are adjusted self-locking through the compression spring 83 during actuation of the drive lever 2 and consequently take out any play conditioned through tolerances and wear of the structural parts whilst during the resetting through the resetting spring 34 the wedge faces 533, 543 of the actuation levers 53, 54 press against the smooth wedge faces of the expansion cam 33 and the latter can radially escape conditioned through the wedge angle α whereby the loop spring 6 can lift off from the cylindrical inner wall of the drive wheel 1 so that resetting is not impeded. The self locking action which prevails during actuation is thus lifted during resetting of the drive lever 2.

For this purpose the surfaces in the recess 36 of the outer expansion cam 33 as well as the corresponding contact surface of the web 35 have rough surfaces as well as the half wedge angle $\alpha/2$ in respect of the wedge angle α of the wedge faces 533, 543 and 534, 544 and contact faces of the expansion cams 33, 34 which bear against one another with smooth faces and can consequently slide along each other without any self-locking action.

The spring strip 6 is inserted by its parallel angled ends 61, 62 into spring strip sockets 531, 541 of the actuation levers 53, 54 which have at their side opposite the drive axis 10 arms 532, 542 between which is a resetting spring 84 which in addition bears against bearings fixed on the housing so that during swivel movement of the drive lever 2 and the relative movement of the actuation levers 53, 54 resulting therefrom the resetting spring 84 is tensioned.

The sectional view illustrated in Figure 3 of a bilateral drive has in place of two actuation levers mounted without play on the drive axis 10 a one-piece spring-elastic expansion lever 71 with wedge-shaped expansion faces 72, 73 between which is a wedge-shaped expansion cam 33 connected to the drive lever 2. A second expansion cam 34 connected to the drive lever 2 is inserted in a recess 79 of the expansion lever 71 and is supported through a spring 87 for adjusting the first wedge-shaped expansion cam 33.

The rotational bearing of the actuation discs or actuation levers in the embodiments of a bilateral drive according to Figures 1 and 2 is replaced in this embodiment by an elastic connection in the form of an elastic web 76 which is formed through a recess 77 of the expansion lever 71. The expansion lever 71 is preferably a sintered part, a plastics moulded part or a stamped steel part and is mounted without play on the drive axis 10.

A spring strip 6 is likewise provided as a transfer device whose parallel angled spring ends 61, 62 are inserted in spring strip sockets 781, 782 of the expansion lever 71. During swivel movement of the drive lever 2 and the ensuing tilting movement of the expansion cams 33, 34 about a virtual axis lying outside of the drive axis 10 the expansion faces 72, 73 of the expansion lever 71 are forced apart, the spring strip 6 is widened and thus the swivel movement of the drive lever 2 is converted through entrainment of the drive wheel 1 into rotation of the drive wheel 1.

In order to pretension the expansion lever 71 a first resetting spring 85 is mounted between two arms 74, 75 of the expansion lever 71 and forces the arms 74, 75 apart so that the expansion faces 72, 73 thereby bear against the first expansion cam 33. A second resetting spring 86 bearing against the drive lever 2 and against a stop fixed

locally or on the housing ensures that the drive lever 2 is returned to the neutral position once more after a swivel movement.

The sectional view of a bilateral drive illustrated in Figure 4 contains in place of a spring strip inserted in spring strip sockets of the expansion lever 71 a circumferential face 70 which is adapted to the cylindrical inner wall of the drive wheel 1 and forms together with the expansion lever 71 a shaped part 7 which is formed as a sintered part, a plastics moulded part or as a stamped steel part. The shaped part can be inserted without pretension into the cylindrical drive face of the drive wheel 1, can be manufactured cost-effectively, causes no tolerance problems and is mechanically very strong and thus durable.

Also in this design the expansion lever 71 is supported on the drive axis 10 and contains spaced expansion faces 72, 73 between which are mounted the expansion cams 31, 32 which are connected to the drive lever 2. The rotational bearing of the actuation discs 51, 52 or actuation levers 53, 54 in the embodiments of a bilateral drive according to Figures 1 and 2 is in this embodiment replaced through an elastic connection in the form of an elastic web 76.

In order to pretension the shaped part 7 a first resetting spring 85 is mounted between two arms 74, 75 of the expansion lever 71 and forces the arms 74, 75 apart and consequently places the expansion faces 72, 73 against the expansion cams 32, 32 and lifts the circumferential face 70 of the shaped part 7 from the cylindrical inner wall of the drive wheel 1. If the drive lever 2 starting from the neutral position illustrated in Figure 4 is swivelled into one or other direction then a tilting moment is exerted on the expansion cams 31, 32 which forces the expansion faces 72, 74 apart and thus presses the circumferential face 70 of the shaped part 7 against the cylindrical inside face of the drive wheel 1 so that during swivel movement of the drive lever 2 the drive wheel 1 is entrained and turned in the swivel direction of the drive lever 2. The oblong hole 20 with which the drive lever 2 is supported on the drive axis 10 thereby ensures free movement of the drive lever 2.

A second resetting spring 86 bearing against the drive lever 2 and against a stop fixed locally or on the housing ensures that the drive lever 2 is reset back in the neutral position after a swivel movement.

For the function of the embodiment illustrated in Figure 4 it is not necessary for the expansion cams 31, 32 to be mounted on the same side in relation to the drive axis 10. Instead of this the expansion cam 32 can for example also engage between the drive axis 10 and the recess 77 into a corresponding opening of the cross web 71 so that a larger lever arm is provided for the drive cams 31, 32.

In the embodiments previously described and illustrated in Figures 1 to 4 the drive lever 2 is supported through an oblong hole 20 on the drive axis 10 to allow for the necessary play during the tilting movement of the expansion cams 31, 32 and 33,34. The oblong hole 20 however leads to a motion play of the drive lever 2 owing to the absence of centring of the drive lever 2.

On the other hand with the embodiments of a bilateral drive described below and illustrated in Figures 5 and 6 the drive lever 2 is mounted without play on the drive axis and thus without any motion play .

Unlike the embodiments according to Figure 4 the expansion cams 31, 32 are not connected directly to the drive lever 2 or parts of the drive lever 2 but are mounted on a reinforcement lever 41 which is attached for swivel movement to the drive lever 2 through a bolt 91. The drive lever 2 is mounted precisely on the drive axis 10 by means of a bore 21 adapted to the drive axis 10. An additional resetting spring 86 between the drive lever 2 and a bearing fixed locally or on the housing ensures precision centring of the drive lever 2.

During swivel movement of the drive lever 2 in the direction of the arrow S the reinforcement lever 41 is entrained in the direction of arrow V whereby the expansion cams 31, 32 are moved in the direction of arrows F1 and F2 so that the expansion faces 72, 73 are forced apart and thus the circumferential face 70 of the shaped part 7 is pressed against the cylindrical drive face of the drive wheel 1 to entrain the drive wheel 1 in the swivel direction S of the drive lever 2.

Similar to the embodiment of a bilateral drive illustrated in Figure 4 a first resetting spring 85 is mounted between the arms 74, 75 of the expansion lever 71 of the shaped

part 7 to reset the expansion lever 71 into its initial position which corresponds to the neutral position of the drive lever 2.

A second resetting spring 86 bearing against the drive lever 2 and a stop fixed locally or on the housing ensures that the drive lever 2 is reset back into the neutral position after a swivel movement.

The first resetting spring 85 ensures in particular that the shaped part 7 leads during resetting of the drive lever 2 at the end of a swivel movement of the drive lever 2 so that the expansion cams 31, 32 are reset into the initial position corresponding to the neutral position of the drive lever 2 and thus the expansion of the shaped part 7 is lifted which otherwise through the continuing contact of the circumferential face 70 of the shaped part 7 against the cylindrical drive face of the drive wheel 1 would lead to the drive wheel 1 rotating back.

The sectional view of a bilateral drive illustrated in Figure 6 differs from the embodiment according to Figure 5 in that the reinforcement lever 42 is extended beyond the drive axis 10, is attached at the end opposite the expansion 31 by means of a bolt 92 to the drive lever 2 which is mounted without play on the drive axis 10, and is supported by an oblong hole 420 on the drive axis 10. This embodiment enables the second expansion cam 32 to be mounted on the side opposite the first expansion cam 31 in relation to the drive axis 10 and thereby sets up a large lever arm for the tilting movement of the expansion cams 31, 32.

The further structural parts of the bilateral drive illustrated in Figure 6 correspond to the structural parts and function of these structural parts for the embodiment illustrated in Figure 5 and consequently are assigned the same reference numerals.

LIST OF REFERENCE NUMERALS

1	Drive wheel
2	Drive lever
6	Spring strip
7	Shaped part
10	Drive axis
20	Oblong hole
21	Bore
31, 32	Expansion cams
33, 34	Expansion cams
35	Web
36	Recess
41,42	Reinforcement lever
51,52	Actuation discs
53,54	Actuation levers
61, 62	Angled spring ends
70	Circumferential face
71,	Spring-elastic expansion lever
72, 73	(Wedge-shaped) expansion faces
74,75	Arms
76	Elastic web
77	Recess
79	Recess
81,82	Resetting springs
83	Compression spring
84-86	Resetting springs
87	Spring
420	Oblong hole of the reinforcement lever
510, 520	Bores
511, 521	Spring strip sockets
512, 522	Bearings
513, 523	Bearings
515, 525	Expansion faces
530, 540	Bores

531, 541	Spring strip sockets
533, 543	Wedge faces
534, 544	Wedge faces
781, 782	Spring strip sockets